TAMARIND LITHOGRAPHY WORKSHOP, INC. 1112 N. Tamarind Avenue, Los Angeles, California 90038

Paper

The manufacture of paper by hand enjoys a long and fascinating history — the unbroken tradition of an esthetic craft and a practical art. The art of papermaking gives us our most basic material for written communication: the silent tongue frequently more eloquent than our speaking tongue. In the papered world in which we live, a world of bank notes, billboards, and belles lettres, we tend to forget the tool which first made possible this handsome material: the paper mold — simple and ingenious — which is the central figure of this article.

by Quentin Fiore

Quentin Fiore, graphic designer, calligrapher, typographer, and paper enthusiast, became interested in the neglected study of handmade paper some years ago. Mr. Fiore regards paper as not merely a surface but an integral part of any graphic presentation. The hand-decorated paste-paper at right was made under his direct supervision.

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In dedication to the late Harrison Elliott, friend and paper scholar — a modest tribute to his kind encouragement and expert guidance in the study of the "white art."

Courtesy of the Museum of Natural History

Handmade paper is a jewel, sought after by those whose tastes crave something that has been touched by human hands; something nurtured by tradition and with a personality all its own. Paper as we know it today is far removed from the delicate craft of the papermaker whose traditions stretch back nearly two thousand years and across the world. It took handmade paper a millenium (105 A.D. to 1151 A.D.) to make its remarkable journey from China, through the Middle East and Africa, and then to Europe through Spain, where the Pillars of Hercules were just an invasion away from Moorish Africa.

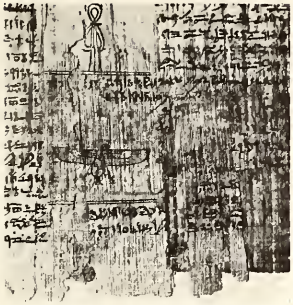
But eons before man produced paper, it was being made in the great coal forests of the carboniferous era, when among the lords of the earth were some of the insects of today. Among these was the *Hymenopterous* of the family of *Vespidae*, known simply as the "paper wasp." Millions of years ago, this lowly insect, which we have good reason to shy away from, developed the first true paper. We have had to learn to imitate the natural process of this winged papermaker who, without benefit of vats, molds, beaters and all the other appointments of the papermaker's trade, nibbles away at any source of dry wood, masticates it, and then exudes a paste-like substance which serves as a binder for her miraculous product. With this paper, she constructs a form of habitation that is, apart from the material used, a marvel of technology to which architects are returning as a source for creative inspiration.

Many materials were used for the purpose of communication before man learned to imitate this first papermaker. Thoughts, in the form of words and images, were *carved* upon stone; *scratched* into clay tablets; *cut* into brass, copper, bronze, lead, and wood; *painted* upon the walls of caves, leaves, and barks of trees, upon laminated surfaces such as Amatl, Huun, Tapa, and Papyrus, on cloth such as silk, and also upon animal skins—vellum and parchment. Before speaking of paper, it might not be amiss to clear away two common misconceptions of paper on the part of some. One of the materials used as a writing surface before the development of paper is particularly important because it has mistakenly come down to the present day as the first form of paper. The word for it, familiar to every schoolboy, is "papyrus." The mistaken notion is perhaps due to the etymology of "paper": the Latin word "papyrus," from which our word "paper" derives. Thus papyrus is often confused with paper, or at best, thought of as its earliest form. It is in no sense either of these things, for papyrus was made from the pith of a tall sedge found in great quantities along the banks of the Nile and was used as a writing substance in Egypt and by the neighboring Mediterranean people. The basic difference between paper and papyrus lies in their manufacture: papyrus is a *laminated* surface of strips of the sedge pith while paper is made by *macerating* fibers to produce an aqueous solution of pulp.

Another substance which is often confused with paper is so-called "rice paper." Much prized by some as the most typical product of oriental papermakers, this elegant, very white thin substance is not paper at all. In reality, it is the pith of a plant that grows in Formosa, which is cut spirally into strips, and is usually used to make charming artificial flowers. Unfortunately, and inaccurately, the term "rice paper" has come to mean *all* oriental papers. Although rice is the universal staple of the Orient, it cannot be used to make paper.

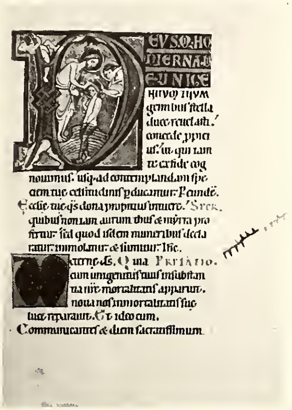
Before the advent of paper, and for several hundreds of years after its appearance in Spain, Europeans derived an exquisite writing surface from the prepared skins of lambs and calves. These skins were made into vellum and parchment and were used by the scribes and illuminators of medieval Europe in place of papyrus, since the papyrus sedge could not be practically raised on the continent. Man's ability to "make do" with the materials available to him accounts for the many differences in paper throughout the world. For instance, the Arabs of Samarkand (751 A.D.), although they had probably come into contact with oriental papermaking through wars, had no mulberry tree from which to form paper; linen rags, plentiful in the land at the time, were therefore used as a substitute pulp material. Apart from various substitutes proposed from time to time, there are, broadly speaking, two basic categories in which hand papermaking materials fall: vegetable fibers in their natural state, and cotton and/or linen rags. Vegetable fibers are used in the Orient, while rags form the basis from which pulp is made in the West.

Post-horn—French, 16th Century watermark



The Pierpont Morgan Library

The Egyptian Book of the Dead *on papyrus — a laminated substance made from the inner bark of a tall sedge found along banks of Nile.*



The Pierpont Morgan Library

The Berthold manuscript (German) written and illuminated on vellum, an exquisite medieval writing material from skins of calves.

Courtesy American Museum of Natural History

Writing on birch bark. An example of primitive man (in this case the American Indian) writing on a surface most available to him.

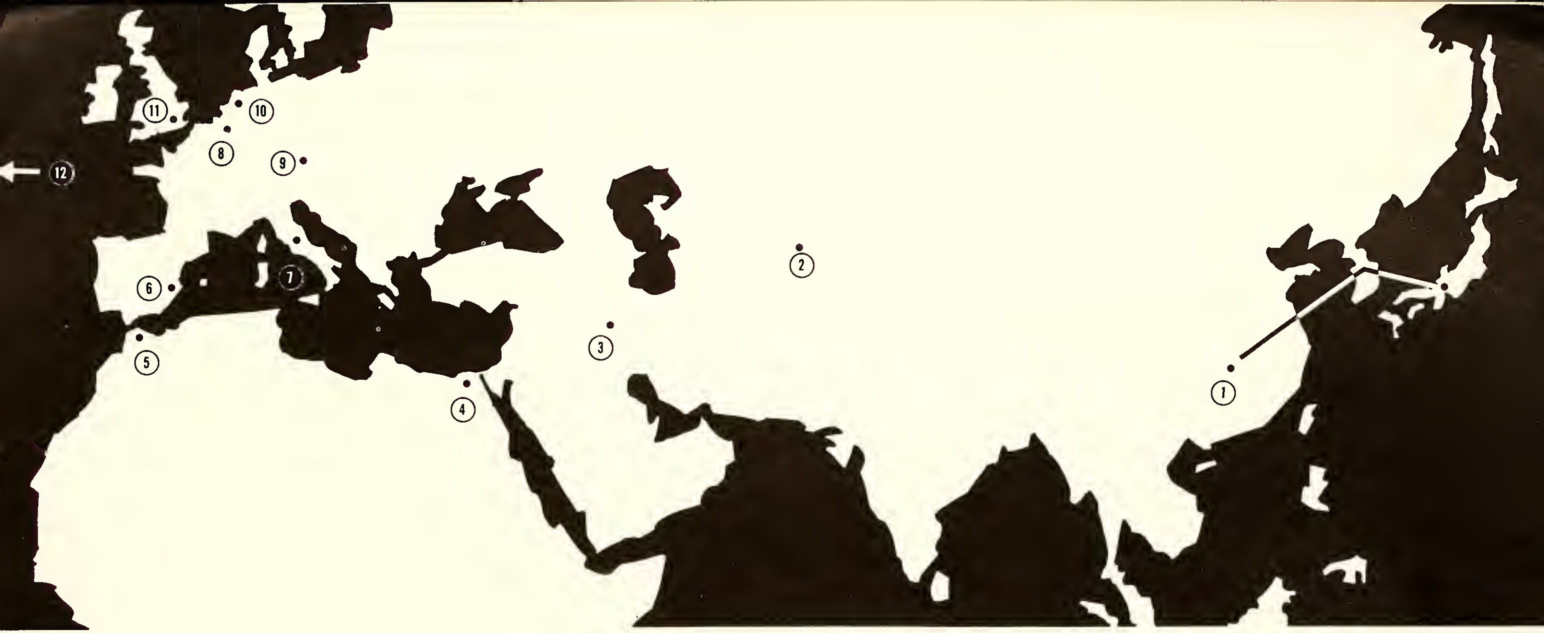
If there is one man in all history who deserves credit for conceiving the process by which handmade paper is made, he is a Chinese eunuch named Ts'ai Lun, a privy councilor to the Royal Court of Ho Ti. An ancient Chinese scholar wrote: "Under the reign of Ho Ti (89-105 A.D.), Ts'ai Lun, of Lei-yang, conceived the idea of making paper from the bark of trees, discarded cloth, and hemp well-prepared; the paper was then in use in the entire universe." Perhaps Ts'ai Lun, denied the pleasurable pursuits that often distract other men, found time to gaze at the paper wasp and wonder why man too could not make paper. But Ts'ai Lun did find time to become involved in a court intrigue as an inventor of slanders against a member of the Imperial family and his end was worthy of the most confirmed stoics of another culture: having given himself up to the minister of Justice, Ts'ai Lun experienced such deep feelings of remorse and shame that he ended his life by bathing and dressing himself in his most elaborate robes and quaffing poison. Ts'ai Lun left behind him a legacy far greater and of far more import than that of many a conqueror. History, full of Tamerlanes and Caesars, records only one Ts'ai Lun.

Ts'ai Lun saw, with unusual insight, the possibilities of manufacturing a writing substance from strips of silk which remained after newly mounted scroll manuscripts had been trimmed. Waste of this sort would naturally concern a man with the type of mind with which Ts'ai Lun was endowed. It was clear to him that after beating these silk left-overs until they were reduced to a fibrous pulp, some contrivance was needed upon which this aqueous substance could be poured and, after drying, formed into a writing material of very economical manufacture. What was required was a screen which would retain the matted fibers on its surface and at the same time allow the excess water to drain through. Thus was born the paper mold, and it is to this simple device that this article pays homage.

The paper mold—simplicity and ingenuity

This tool, the paper mold, is profoundly important to mankind. It was created in response to a particular need and, because of its basic design, has not changed appreciably in nearly twenty centuries. There have, of course, been a number of innovations, the most interesting of which was —in answer to the nineteenth century's demand for more and more paper—the Fourdrinier, or continuous web, papermaking machine. But it is the story of hand papermaking —the tool and the process—that concerns us here.

Before describing the paper mold in detail, it may interest the student of etymology that some paper scholars claim that a term widely used today had its origin in the paper mold; namely, that "format," so bandied about these days in fields as far removed from papermaking as television and advertising, is derived from the French name for the tool—*forme. Format,* in the sense in which it was first used and is still used in France, refers to the size of a sheet of paper as formed in the paper mold.



PAPER'S LONG JOURNEY FROM CHINA IN 105 A.D. TO THE AMERICAN COLONIES—1690

1 105 A.D.—Paper invented by Ts'ai Lun in Lei-yang. 610—Paper introduced into Japan via Korea. 770—The Million Prayers of Empress Shótoku, first text printing on paper. **2** 751—Paper made in Samarkand, presumed to have been learned from Chinese prisoners of war. **3** 793—Baghdad: paper introduced by Harun-al-Rashid, learned from Chinese in Samarkand. **4** 900—Paper made in Egypt, employing Chinese methods of manufacture. **5** 1100—First papermaking in Morocco—from Egypt. **6** 1151—World's first stamping mill at Xátiva, Spain; motivated by water power until invention of "Hollander." **7** 1276—establishment of paper mill at Fabriano (oldest continuously operating paper mill). 1282—First known watermark of Europe, at Fabriano. **8** 1348—First paper mill in France, at Troyes. 1719—René Antoine Ferchault de Réaumur suggests use of wood for pulp. 1777—"Wove" (papier vélin) exhibited in Paris by Benj. Franklin. 1798—Nicholas-Louis Robert invents continuous web paper-making machine. Called to this day the Fourdrinier because it was developed in England by two brothers of that name. **9** 1390—Mill established at Nurnberg by Ulman Stromer (famous "S" watermark); first known paper-maker's strike at this mill. 1450-5—Gutenberg's 42-line Bible published. 1540—Glazing hammer, supplanting hand burnishing of paper, invented. 1595—First "paste-papers." **10** 1322—First *use* of paper in Holland. 1680—invention of the "Hollander," a machine supplanting primitive beaters motivated by wind or water. **11** English mill established in Hertfordshire by John Tate. 1757—Introduction of "wove" paper, made by Turkey Mill for John Baskerville. 1848—Chiaroscuro watermarks invented by Wm. Henry Smith. **12** 1690—Founding of first American mill in Germantown, Pa.

Bull's head—French, 16th Century watermark

Mitsumata

Kozo

Gampi

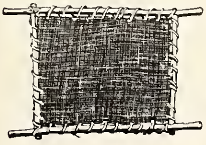
Tororo-aoi

Handmade paper is formed in two ways. In the primitive manner, which is still practiced in some of the remote areas of the Orient, the pulp is *poured* upon a cloth of woven grass stretched taut by a frame of bamboo. This grass cloth is firmly affixed to its frame. The wet sheet of paper thus formed remains on the surface of the mold and is left to dry. The second and more highly developed manner of forming paper is as disarmingly simple as the first process. In this, the *mold* is *dipped* into a vat filled with pulp, lifted, and rhythmically shaken to ensure even distribution of the pulp. The sheet is then dried.

However, because the newly formed sheet of paper remained in the mold until dried, a mold was needed for each sheet. For a thousand sheets a thousand molds were required. As a result, a flexible, removable bamboo covering, *which could be rolled off its frame*, was developed. This simple, ingenious device enabled the early oriental papermakers to simply roll off the mold covering upon which lay the newly-formed sheet of paper, place the sheet in the sun to dry, return the mold covering to the frame, and repeat the process. The simple beauty of this tool, sometimes referred to as the "transfer" mold, is an excellent example of technology in its simplest form.

The split bamboo covering of the transfer mold was held in place during the dipping process by loose sticks the same length as the short ends of the rectangular frame. These were grasped by the right and left hands of the papermaker, completing the right and left side of the deckle. The early Chinese papermakers followed a policy of using readily available material to make paper, and therefore used silk in both its raw or woven state before discovering the use of mulberry bark, bamboo hemp, and a wide variety of materials for the basic ingredient—pulp. It should not be surprising, then, that the Chinese character for silk forms part of their character for paper.

糸　紙

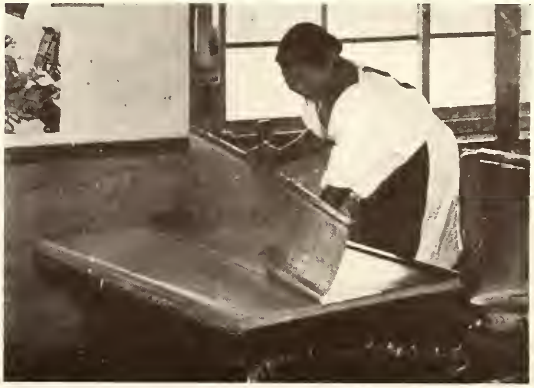


A sketch of the most primitive type of mold of the Orient. The surface of the mold is made of grass, giving it a "wove" formation. The four edges of the mold are constructed of the handiest material available: bamboo. In this mold, pulp is poured *upon the surface.*

It should be mentioned here that we owe a very great debt to the Chinese for their contributions to the art of papermaking. Unfortunately, present strained relations do not permit correspondence with these people and make it difficult, if not impossible, to procure illustrative material and specimens from China. Since the variations between papermaking in Japan and China are slight, we take Japanese processes and tools as our model.

The love of the craft in Japan

Japanese papermaking represents to the highest degree the oriental attitude towards this ancient craft. The very choice of ingredients for pulp takes on something more than the mere raw materials required to make a sheet of paper. Soetu Yanagi, the eminent Japanese folkcraft scholar, in speaking of the three major sources for pulp in Japan, says: "*Gampi*, *Kozo*, and *Mitsumata*—these build a triad of



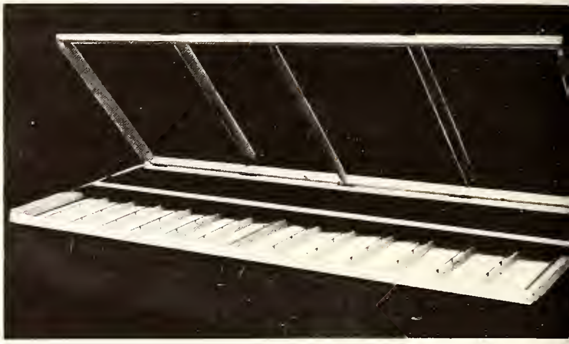
A Japanese papermaker removing wet sheet from flexible bamboo mold covering. The wet sheet is simply pulled off *the covering and neatly stacked. Use of* Tororo-aoi *mucilage prevents sticking.*

papermaking materials, with the various kinds of Japanese papers taking their seats somewhere in this triad; *Gampi*-paper sitting at the top, *Kozo-paper* on the right, and *Mitsumata-paper* on the left. In its dignity and lustrousness the beauty of *Gampi* is peerless, and its life endless. No paper under the sun can be nobler than this. Soft and hard, negative and active, go hand-in-hand herein. *Kozo* is the sterner sex who keeps guard over the land of paper. Its sinewy, tough fibers can bear any rough work. To this does Japanese paper owe its strength even now. Were it not for *Kozo*, how effeminate the world of paper would be! Beside *Kozo, Mitsumata* is the gentle sex which softens the realm of paper. No paper can be more graceful than this. It is of fine texture, smooth skin, and sweet temper. Without *Mitsumata*, paper would decrease in tasteful delicacy. In concert with *Kozo*, it has kept on protecting the life of Japanese paper...."

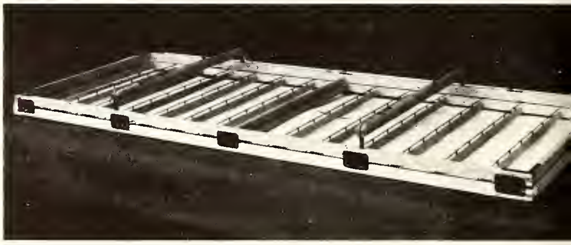
These three—*Kozo, Gampi,* and *Mitsumata*—are the deciduous plants which are used in Japan for papermaking more than any other vegetable fibers. The best of the three variants of *Kozo* is scientifically called *Broussonetia Kazinoki,* popularly known as the "paper mulberry." Before the advent of paper into Japan, the people were said to have woven cloth from its bark and offered the cloth to the gods during festivals. Paper made from *Kozo* is resistant to water and is used in the manufacture of *Shoji* and *Kappa* (paper raincoat). *Mitsumata* (belonging to the *Daphne Odora* family) is so named because of its distinctive appearance–three branches issuing from an upright stem. Hence its name, "three forks." *Gampi*, referred to as the "king of papers," is a plant which resists cultivation and as a consequence is scarce. This naturally increases the cost of manufacturing *Gampi*-paper above the others.

The invention of the hinged mold

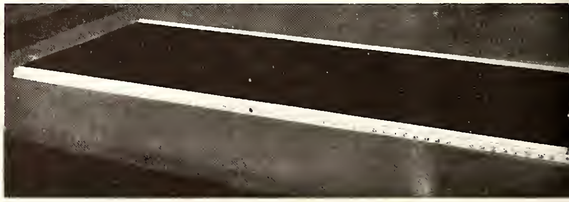
The earlier transfer mold which originated in China and came to Japan by way of Korea was improved upon by simply hinging the deckle to the frame at one end and providing clasps at the other, so that when the papermaker wished to remove a newly-formed wet sheet of paper from the flexible bamboo covering, he undid the clasps and opened the deckle. This improvement gave the papermaker greater freedom. He no longer needed to be concerned with keeping the deckle firmly in place while dipping. Also, as can be seen in the illustration, two handles, considerately oval-shaped for the user, were provided. The entire tool is of very light construction, a fact greatly appreciated when we realize the enormous weight of pulp. It is usually made of unpainted cypress and reinforced at important structural points by copper strips. The flexible, movable mold covering consists of finely split, rounded bamboo splints. These form the "laid" lines and are spaced about 28 to the inch. In turn, these are chain-stitched together in the opposite direction by silk thread and are called "chain lines." These chain lines are approximately one inch apart.



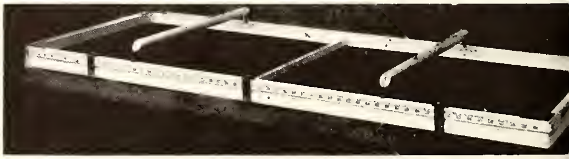
A Japanese hinged mold, shown open, with its flexible and removable bamboo covering rolled back. Note the three clamps hanging down in front. The upper part of the mold, which constitutes the deckle, is hinged to the frame in the back — as seen below.



This is essentially the same view as above but seen from the rear, with the mold closed and its bamboo covering removed. When the covering is in its place in the mold and ready to form a sheet, it rests on copper wires running along top edge of the elevated ribs.



The flexible bamboo mold covering without the frame. All oriental molds are made by placing finely split bamboo splints that form the "laid" lines (app. 24-28 per inch) which are sewn perpendicularly together by silk, thus forming "chain" lines (app. 1" apart).



The complete mold — closed and ready for the process of forming a sheet of paper. Clamps are locked. The handles are oval-shaped to fit more comfortably in hands in the shaking process. The central divider makes it possible to form two sheets simultaneously.

Cluster of grapes—German, 15th Century watermark

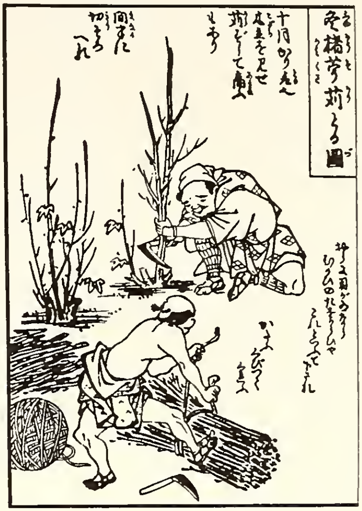
Basically, the steps taken to prepare papermaking material in Japan consist first of cutting into equal lengths shoots of either *Kozo, Mitsumata* or *Gampi* and tying them into faggots which are placed upright above a boiling cauldron and steamed. (The bark of *Gampi* is stripped without being steamed, and for this reason the shoots of this plant are cut in early summer when its sap is running.) After the steaming process, the outer bark is removed and is ready for the next step—*beating*. Many peasants and Buddhist monks are engaged solely in this work and sell their produce to papermakers in their vicinity. These fibers are called *kuro-kawa* (black bark) by the Japanese. *Kuro-kawa*, to be useful as papermaking material, is further treated by long immersion in running streams to remove all imperfections, such as knots, etc. The Japanese call the product of this process the *siro-kawa* (white bark). The white bark is then stored in great quantities and further boiled. This boiling is done in a lye solution made from wood ashes, buckwheat ashes, or slaked lime. The lime is removed from the *siro-kawa* by immersing it in water for as long as three days. This bast is then beaten on oak boards or granite slabs, depending on the papermaking district.

Apart from the occasional employment of the water buffalo to stamp the prepared inner bark of plants in a circular potching trough, or the use of an animal to motivate a stone roll, the mortar and pestle and the mallet provide the two main means for macerating vegetable fibers for papermaking in the Orient. The obvious advantage of the trip-hammer as a labor-saving device is still resisted by a great number of these craftsmen, for they believe that hand beating, which seems so primitive to us, assures them a material whose fibers are the correct length. It is difficult for Westerners to comprehend the importance assigned to this stage of papermaking by his oriental brother. The preparation of vegetable fibers to form pulp is the *mystique* of all oriental papermaking. Time and again these craftsmen refer to the ancient and time-honored manner as the *best*.

The beating of fibers is usually performed by village girls and at times extends far into the night in order to provide the vatman with a full vat the following morning. Most of this activity takes place during the winter months to supplement the income from a usually meager harvest. The following lines beautifully illustrate the sensitivity combined with stark realism of the type of ballad sung by the paper beaters in Japan:

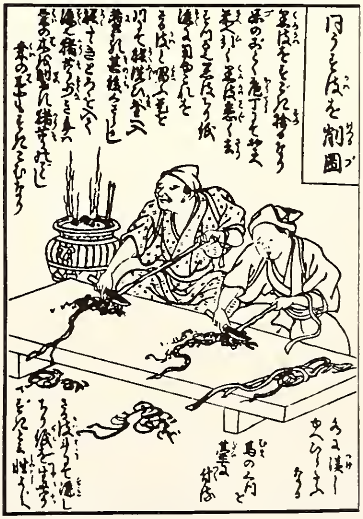
> *"At Simo-gyo the winter seems to have come*
> *With the dreary sound of pulp beating . . ."*

Reproduced at right are eight pages of the more important steps in the oriental papermaking process. The illustrations are taken from the first book to be published on the subject in Japan, "Kamisuki Chohoki" by Kunisaki Jihei, 1798. These beautiful drawings graphically explain an oriental method of making paper by hand. It is interesting to compare this technique, which is one of the oldest in the world, with the photographs on the following spread showing hand paper-making in a typical English mill today.

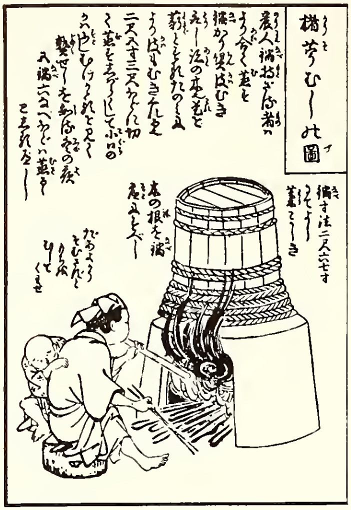


The first step in papermaking process is getting the raw material. Here branches of plants suitable for paper are being cut evenly in middle, cinched tightly in large bundles and are then sold to papermakers.

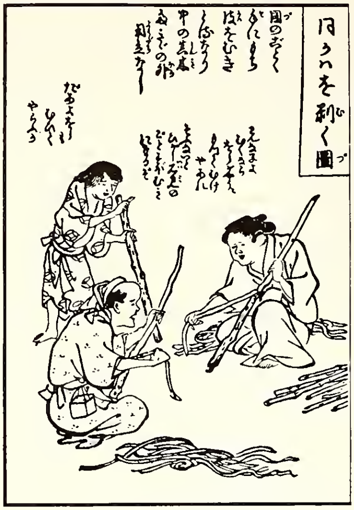
The outer (black) bark is completely removed. What remains after this step is allowed to rot. Afterwards, it is mixed together with a mucilaginous plant (Tororo-aoi), which acts as a very strong binder.



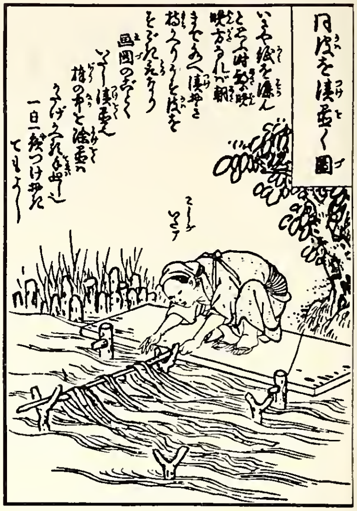
Eight major steps in the papermaking process in Japan as practiced since 610 A.D.



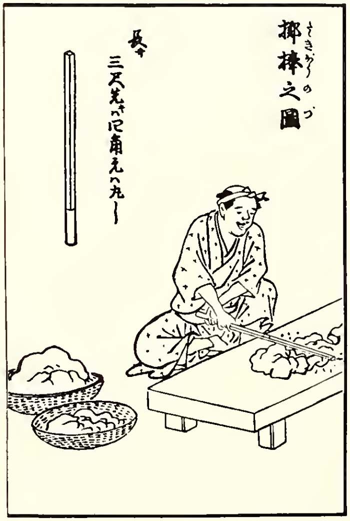
Bundles are placed upright over boiling cauldrons in order to separate the outer bark from the inner. The presence of the baby shows how much a part of a peasant's domestic life the art of papermaking is!



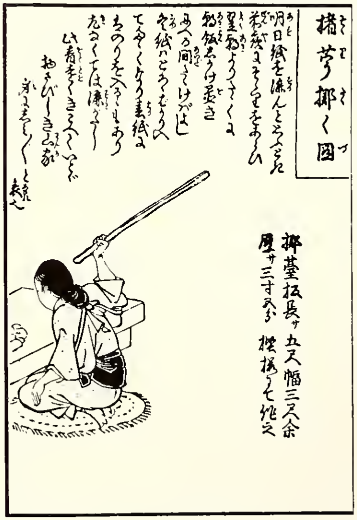
The bark, which is now separated from the core; is peeled off in preparation for the following step. The core is not used in this Japanese papermaking process: it is usually sold in the market as firewood.



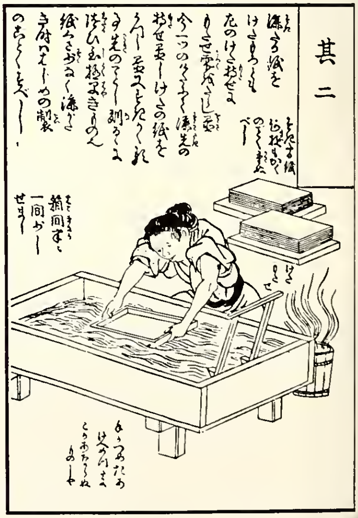
The bark is then immersed in a running stream for a period of time in order to remove all imperfections, such as knots. The Japanese call the product at this stage of the process Siro-Kawa *(white bark).*



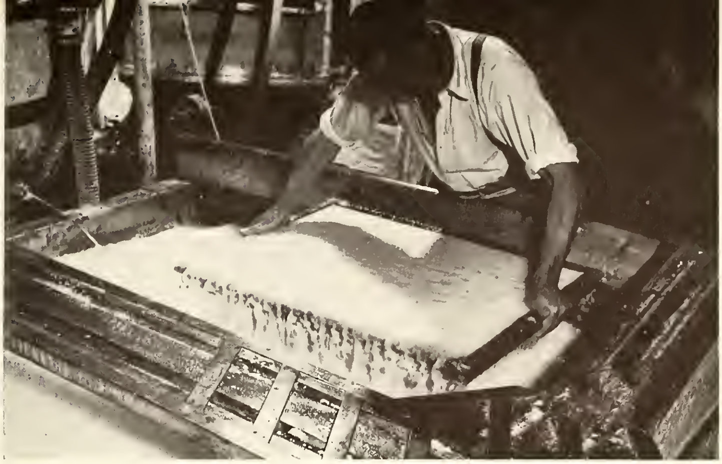
The papermaking bark is shown here being beaten. (A typical beating stick can be seen at upper left-hand corner.) This work, which is near the end of the process, takes much time and patience to perform.



The beating of the fibers is usually done by village girls. The sound of the beating was described by a Japanese poet as "touching to the heart," and forms distinctive aspect of the Japanese craft.



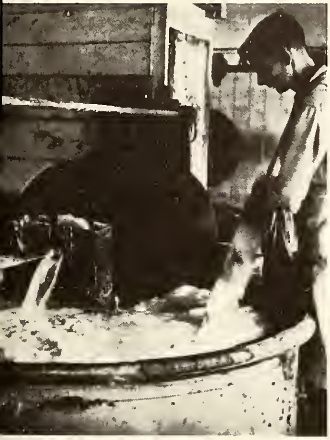
A woman forming Hanshi *paper, dipping mold into vat. In background are neat piles of newly-formed stock. The paper is then dried and packed. The text says woman complains of the coldness of her hand.*

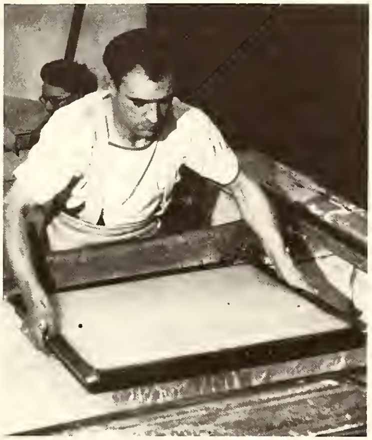


Esso Petroleum, Ltd.

Vatman forming sheet of paper. The surplus pulp runs over far side of mold. Mold is of light construction because weight of pulp and suction is great, as can be seen by tenseness in muscles. Experienced vatman forms many sheets, all "uncannily" of same weight.

The Western method of papermaking photographed in a





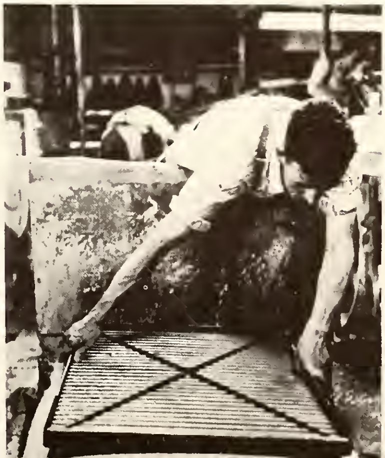
The London Times

1 *Worker stirring rags in beater. Rags have already been* sorted, cut, *and* boiled. *This step is the final one in the complete disintegration of rag in order to form pulp.*

2 *Vatman forming sheet. Note the wave of pulp traveling towards him. Pulp is evenly distributed over surface of mold; deckle is in position. Note draining.*

3 *Coucher laying newly formed sheet of paper from mold given him by vatman. The mold upside down, the paper is placed between sheets of felt. This is called the "post."*

4 *The post is put into hydraulic press to squeeze out excess water. Water dripping from sheets is called "sweat." Pressure applied varies according to the type of paper.*



typical English mill—J. Barcham Green, Ltd.'s Hayle Mill, Maidstone, Kent, England

5 *The "layman" piles neatly pressed sheet of paper on his inclined table. He removes the felts and returns them to the coucher. Vatman, coucher, layman form "trinity."*

6 *A "dry worker" hangs spurs (about 4 sheets) of paper on cow-hair ropes to dry in loft. Middle left, paper dries flat on canvas. Hayle Mill now uses this method only.*

7 *A familiar sight in the old handmade paper mills. This final drying is done in the loft, whose walls are made of slats to allow free flow of air. Next: glazing, sizing.*

All photos, unless otherwise noted, courtesy of Melvin Loos, Columbia University.

Fleur-de-lys — German, 16th Century watermark

Stamping mills used for preparing rags for papermaking—from Cartiere Miliani, at Fabriano, Italy (a mill in continuous operation since the 13th Century). The stamping machines shown above are very similar to those first used in Xátiva, Spain in 1151. It was said of the loud sound of these stampers: "God would thunder in vain to make Himself heard."

In Japan, the actual process of making paper by hand can be roughly divided into four phases; the first is the preparation of the vegetable fibers, the second consists of forming the sheet of paper, the third, removing the newly formed sheet of paper from the mold and placing it in a neat pile, and the fourth, the actual drying of the wet sheet of paper.

Balls of pulpy vegetable fibers that have been treated are placed in wooden tubs or vats, (hune—"boat") into which water is added. Usually there is a seventy to thirty per cent water to pulp ratio. This is thoroughly mixed by means of a huge comb-shaped agitator. In the various papermaking districts of Japan, these wooden tubs are as common as sewing machines are in American farmhouses, and the very thin, elegant papers of Japan, which possess such remarkable tensile strength, are made by peasant women.

Tame-zuki, the first and oldest of the two methods used to form paper in Japan, and which is believed to have come from China, is quite similar to the European method. The mold is *dipped* into a vat filled with pulp, lifted and shaken in two directions. This action allows the pulp to be distributed evenly over the surface of the mold and permits the excess water to drain through the sieve-like surface of the mold. The wet, newly formed sheet is removed from the mold covering. In the Orient, sheets of newly formed paper are simply piled one upon the other without the use of interleaving layers of felt as in the West. Great weights are placed upon these piles of wet sheets. This removes about eighty per cent of the water. Finally, in the last stage of the drying process, these damp sheets are usually brushed onto long boards and permitted to dry in the sun. This is the most ancient manner of drying and is completely dependent upon the caprices of the weather. Another way of drying paper is by steam-heaters, but this method does not produce the finest papers. As in China, the damp sheets are sometimes placed on the ground (uncultivated burial grounds are choice spots), or simply brushed onto the walls of a cottage.

Nagasi-zuki, the second and relatively newer method of Japanese papermaking, is most often distinguished by the fact that the mold is not dipped into the vat, but instead the pulp is *poured* upon the surface of the mold to make a sheet of paper. A type of mucilaginous substance is added to the pulp. This "paste" is derived from the *tororo-aoi* (*Hibiscus Manihot*) and the *nori-utugi* (*Hydrangea Paniculata*), which is popularly referred to as the "paste tree." This manner of forming paper is in reality the more ancient of the two since it was used in China long before the introduction of paper into Japan. The mold in this method is also shaken and the wet sheet laid. The Japanese papermaking processes described above are the same used today as they were almost two thousand years ago, and in all probability will continue to be used for years to come.

Waterpower and wind mills in Europe

As paper found its way into Europe through North Africa, the distinguishing characteristics of the oriental method of macerating fibers changed from manpower to the use of water power and windmills, which are typical of the paper mills of Europe. It is generally thought that the early papermakers of Europe used for a brief time the same method of beating fibers as their oriental counterparts. But this changed rapidly. The first stamping mill operated by water power in Europe was erected in Xátiva, Spain, about 1151.

Instead of vegetable fiber, the basic raw material for the manufacture of paper was linen and/or cotton rags. These were soaked and made into balls which were permitted to remain in this state for as long as two months at a time. The ball of rags in this state slowly fermented as its temperature increased. Only one third of this ball was actually suitable for papermaking. The appearance of fungi on this huge ball was considered a sign that the material was ready for beating in the stamping mill. (It is now thought that the *"foxing"* found on pages of many books printed between the sixteenth and the early nineteenth centuries was the result of the rags' being subjected to the extreme processes and fermentation.) The use of lime to speed the disintegration was occasionally resorted to, but was eventually prohibited by government fiat. With the advent of the invention of movable type in the middle of the fifteenth century and the consequent demand for a greater supply of paper, these stamping mills became larger and more complex.

The large stamping mills of the continent, which used the superior force of water power, were formidable competition for the Dutch papermakers who were obliged to supply huge quantities of paper to their expanding nation. These Dutch mills were constrained to employ wind as power to motivate their stampers. An ingenious device for the beating and macerating cotton and linen rags was invented sometime during the last quarter of the seventeenth century. Although the name of its inventor is lost to history, this type of beater, which supplanted the earlier stamping-mill, is referred to as a "Hollander", after the country of its origin. Its appearance is distinctive and has changed but slightly these past centuries. It is an oblong vat with rounded ends, having, at one side, a solid wooden roller equipped with a number of knives upon its surface. The use of this beater greatly increased the output of pulp for papermaking. It now became possible for the Dutch papermakers to meet the greatly increased demand for paper. It was thought by many that rags so macerated would not possess fibers long enough for the proper preparation of pulp. In fact, many mills in Europe hesitated using this "new-fangled" gadget for some time, but the pressure of the "immutable laws of economics" won out. It is now in universal use throughout Europe.

New materials sought

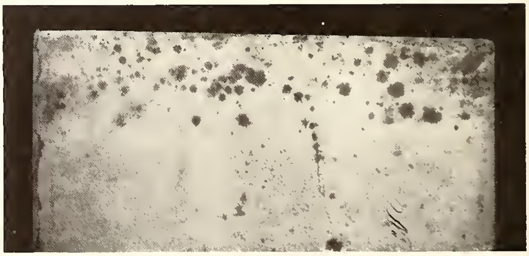
With the introduction of papermaking on a large scale, a shortage of rags developed. All manner of government edicts were enacted to encourage the populace of Europe and America to conserve these materials. In England, at one time, a law was passed forbidding anyone to be buried in clothing other than wool, a material which is not suitable for papermaking. A French scientist, René Antoine Ferchault de Réaumur (1683-1757) turned once more to the paper wasp and, by observing the almost continuous labors of this insect, came to realize that wood could be used to replace cotton and linen fibers in the fabrication of paper. Réaumur's proposal was a revolutionary one, since the growing lack of cotton and linen had become a source of great concern to the papermakers and legislatures of his day. A state of emergency existed at that time not unlike the one during the recent war, and severe penalties were meted out to anyone found guilty of wasting these precious materials. A new material had to be found and again the paper wasp led man to a solution! Practically all machine-made paper is made from pulp which is formed in great part by wood. It must be stressed, however, that cotton and linen rags are still used today by *hand paper mills* in Europe. (There are no known commercial manufacturers of handmade paper in existence in the United States.)

Jacob Christian Schäffer (1718-1790), in a now extremely rare work of six volumes, proposed the use of, and successfully made paper from, the following: wasps nests, moss, various vines, hemp, straw, cabbage stalks, thistles, turf, marsh-mallow, asbestos cattail, burdock stalks, Indian corn husks, genista, pine cones, potatoes, old shingles, reeds, beans, horse chestnut, walnut, tulip, and brazil-wood.

In the history of papermaking, as in the history of other fields of human endeavor, certain men are known to us almost only by name and what they contributed to the particular field of their calling. Matthias Koops, a Dutchman residing in London during the nineteenth century, is one such man. If Jacob Christian Schäffer gained his recognition for the discovery of new, and sometimes surprising, sources of papermaking materials, credit should be given to Matthias Koops for having created public interest in England's biggest paper mill and for having been the first man to produce commercially, and in large quantities, paper made from a material other than the extremely scarce rags—wood. In 1800, his greatest work, "Historical Account of the Substances Which Have Been Used to Describe Events and Convey Ideas, from the Earliest Date to the Invention of Paper", appeared—printed on paper made entirely from straw, with an appendix printed on paper made from wood alone.

Introduction of the rigid wire mold

In its westward course, other changes in this ancient craft took place. For example, by the time the Arabs had become familiar with paper, they had developed the art of wire-drawing to a very high degree. It was this invention that permitted Europeans of the twelfth century to perfect the art of papermaking much earlier than would otherwise have been possible, for Europe lacked that pliant, strong, and highly practical material—bamboo. An adaptation of the remarkable tool, the mold, was now made feasible by the existence of this new material—brass wire. The European "rigid" wire mold consists of two main parts: the deckle and the mold. The deckle is actually a removable wooden frame of exact fit for the mold. It forms a raised edge which serves as a barrier to prevent the thin layer of fibrous pulp from running over. The depth of the deckle is determined by the substance of the sheet to be formed. Also, the size the sheet is determined by the dimensions of the deckle. Because of the inevitable shrinkage of the sheet of paper after drying, allowances of one-quarter to one-half inch are usually made. The term "deckle-edge" refers to the distinctive irregular edges of a sheet of handmade paper. These edges are the result of the liquid pulp creeping under the



The spots on the paper are called "foxing." It is believed that these spots (brownish in color) which appeared on the paper of books printed between the sixteenth and nineteenth centuries were caused by the excessive fermentation of the papermaking rags. Although the theory is not proved, it seems plausible.

Pilgrim—Italian, 16th Century watermark

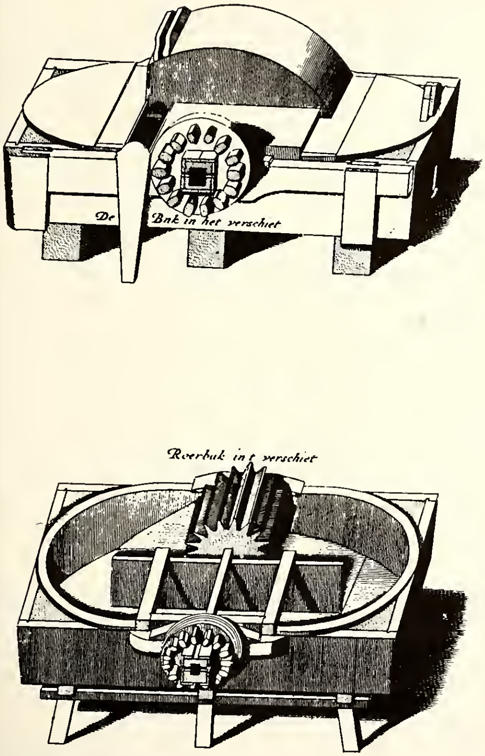
deckle. Originally these crude edges, considered merely an unesthetic result of the papermaking process, were sheared off by bookbinders to prevent dust from settling upon books. It is only in comparatively recent times that the retention of "deckle-edges" in book work has come to signify a sure sign of craftsmanship, found only in deluxe editions.

The tyro, elated by his new discovery regarding chain and laid lines as characteristic of handmade paper, would be denied the satisfaction of his knowledge were he to hold a sheet of "wove" handmade paper to the light. He would see nothing but the slightly mottled fibers found in *all* paper. This type of paper is made from a mold covered by a finely woven mesh of wire cloth instead of the "laid" and "chain" wires used in the fabrication of "laid paper."

Wove paper is basically as old as the art of making paper, but it did not appear in the Western world until the eighteenth century, when John Baskerville (1705-75), famed Birmingham printer and type founder, whose eccentricities passed from life into death by his wish to be interred in the "mill" in an upright position, required a smooth sheet with a calendered surface which would do justice to his types with their finely modeled serifs. Baskerville is often mistakenly credited with having originated the mold for "wove papers." It has recently been proven that this new type of paper was supplied to Baskerville by the Turkey Mill (Whatman-Balston) of Maidstone. The first book to be printed on wove paper was Baskerville's edition of Virgil's Georgics.

Before John Baskerville insisted on wove paper, all handmade paper in Western Europe was of the "laid type," whose process of manufacture has not altered to any great degree to the present time. Hans Sachs, the cobbler-poet of Nurnberg (1539-01) who was immortalized not so much by his own poetry as by Wagner's opera *Die Meistersinger*, wrote the following description of a papermaking mill as it existed in his time: "Rags are brought into my mill/ Where much water turns the wheel/ They are cut and torn and shredded,/ To the pulp is water added;/ Then the sheets 'twixt felts must lie/ While I wring them in my press./ Lastly, hang them up to dry/ Snow-White in glossy loveliness." A bit of poetry, a few words in a diary, something mentioned in a will—these are our only sources for study of the art as it existed in its early days in Europe. The secrets of this craft were jealously guarded by workers and their masters, and since intercourse between the various mills was infrequent, papermakers developed methods and tools peculiar to their localtities.

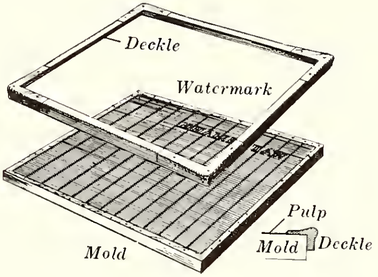
Paper, in the early years, was distrusted in medieval Europe as the product of foreigners and infidels. Another deterrent to the acceptance of paper in Europe was that rags used in papermaking were oftentimes the clothing of those who died in the plagues which periodically decimated great segments of the population. The following amusing observation was written in the early eighteenth century: RAGS make paper,/ PAPER makes money,/ MONEY makes banks, BANKS make loans,/ LOANS make beggars,/ BEGGARS make RAGS.

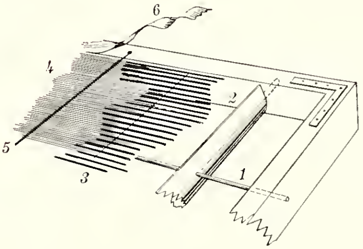


One of the earliest engravings show the new device, the Hollander, which superseded the earlier stamping mills for the beating of rags for papermaking. Upper view shows the machine closed, the lower, open. Wheel has knives for macerating rags. From Groot Volkomen Moolenboek, 1734.

The paper mold

The rectangular frame of the mold is made of mahogany or white wood and sometimes oak. It is reinforced by heavy gage wires inserted into the short sides of the frame (1) *and passed through the ribs. The position of these wires can be changed according to the size of the mold. The ribs* (2) *are wedge-shaped and spaced approximately* 1⅛ *inches apart parallel to the shortest sides of the frame. Their wedge-shape makes it easier for the vatman to lift his tool than it would be if they were flat.*





Paper made before the latter part of the eighteenth century had a shadow-like effect along the "chain lines." This was the result of the pulp lying heavier on each side of the chain lines and was traced to the practice of lacing or sewing the "chain" wires directly to the ribs. Mold-makers in the late seventeen hundreds eliminated these lines by adding backing wires (3) *that would raise the "chain wires" away from the ribs.*

The bottom layer of wires, spaced about 9 to the inch, support the "chain" and "laid" wires, and adds rigidity. The brass laid wires (4) *are spaced 24 to the inch and crossed perpendicularly by the heavier gage chain wires* (5). *The term "chain wires" is used because of the way they are attached to the ribs. Finally, this complex of wires is secured by copper stripping around the frame* (6). *The effect of laid and chain lines in handmade paper is duplicated in machine-made paper by a device known as the "dandy roll." A wire, twisted into any shape and sewn onto the laid wires, is responsible for the watermark.*

Glossary

CHAIN AND LAID LINES: held to be the light, "laid" handmade paper has thin narrowly spaced "laid" lines crossed perpendicularly by heavier, more widely spaced "chain" lines. Lines can be simulated in the machine-made product with "Dandy-roll."

DECKLE: removable wooden frame that fits the mold exactly, forming a raised edge. Serves as a tray which prevents the thin layer of fibrous material from running over the edges.

DECKLE-EDGE: irregular edges on handmade paper that result from liquid pulp creeping under the edges of the deckle. These edges can be simulated in machine-made paper.

COUCHER: workman who piles newly formed wet sheets of paper between alternate felts. From the French *coucher,* to lay down and from the Latin *collocare,* to place.

MOLD-MADE PAPER: a misnomer, for paper so-called is in reality a machine-made product. Usually, pulp used in this form of manufacture is superior to that used for machine-made papers.

MOLD: a rectangular wooden frame upon which brass wires or wire cloth are stretched, thus permitting water to drain through, leaving a thin layer of fibrous material. Two main types of construction—the "laid" and the "wove."

PARCHMENT: writing material used, along with Vellum, before the advent of paper. Made by separating the inner side of sheepskin from the outer (wool) side. Peeled skin is treated to make it suitable for writing.

POST: a quantity of wet sheets of paper, freshly "couched," and ready for pressing. Also, a size of paper and its multiples.

SHAKE OR STROKE: peculiar motion given to mold by vatman to insure even distribution of pulp over mold surface.

VELLUM: the whole skin of a calf treated with lime. Term "vellum" loosely used today to denote paper that resembles parchment.

WOVE PAPER: type of paper made in a mold covered by a finely woven mesh of wire cloth instead of "laid" and "chain" wires. Slightly mottled fibers seen when held to the light.

Bibliography

A great debt is owned to Dr. Dard Hunter by paper lovers the world over for his pioneering efforts in the field. He is the author of many highly authoritative books on the subject and curator of the Paper Museum of the Institute of Paper Chemistry, Appleton, Wisconsin, which contains the most extraordinary collection of paperiana in the world.

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Snail—French, 15th Century watermark

If ever a trinity existed, that of vatman, coucher and layman has been one for centuries. The vatman can be considered as being at the apex, while the other two play supporting roles, for it is the vatman who initiates the forming of a new sheet of paper. The vatman is the personification of the human-turned-machine. With the deckle in place over the mold, the vatman extends the mold vertically into the vat, lifting it filled with pulp; and then, with that motion described as the "vatman's shake," distributes the pulp, first in one direction to level it and then in the other to cause the fibers to set in a cross direction. The entire operation is begun and completed in a matter of seconds. The vatman removes the deckle and passes the wet sheet, still on the mold, to the coucher and is now ready to take another mold and repeat the process. The coucher then couches the newly formed sheet of paper by placing the mold over a sheet of felt. By skillfully applying the right amount of pressure, the coucher causes the sheet of paper to detach itself from the mold and adhere to the felt. He then places another piece of felt on top of the wet sheet of paper, and repeats this process with each sheet given him by the vatman.

The third member of this highly coordinated operation, the layman, is in charge of pressing and separating the felts from the newly formed sheets of paper. Paper is usually pressed a number of times. In the early days of papermaking, pressing was accomplished by means of a windlass, a huge device affectionately called the "Sampson." About 1800, this crude press was replaced by the hydraulic press. Each kind of paper requires different treatment, depending on the intended use of the paper. If the amount of pressure applied is too great, the packs of paper become solid blocks. The water dripping out is referred to as "sweat."

Drying, sizing, and glazing

Once paper has been pressed to remove great quantities of water, it is ready for drying. This is accomplished by hanging the damp new sheets of paper on cords, usually in groups of four or five ("spurs"). As these sheets dry, they become separated. The drying room of a paper mill is usually on the upper floor, having loose slats for walls, thus allowing free movement of air through the room.

A mill worker affixes a watermark to a Dandy Roll. The Dandy Roll is a cylindrical roll which is used in the manufacture of machine-made paper to impart to its surface the "chain" and "laid" lines. Another instance of the machine imitating the hand.

To give paper a surface suitable for writing or printing, it is sized. The section of the mill set aside for this process is colloquially referred to as the "slaughter house" because a great deal of paper is wasted in this process. Size is prepared from the hides, hoofs and bones of animals. In the Orient, however, starch and gypsum are usually used.

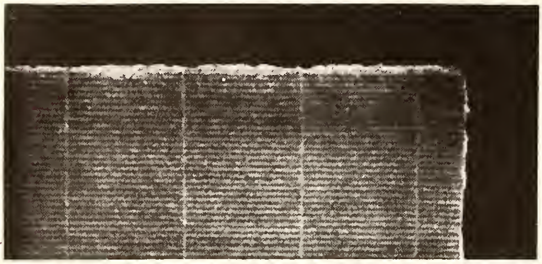
Lastly, paper is sent to the finishing room for "glazing." This room is called the "salle," a term introduced by John Spilman, a German papermaker who resided in England in the 16th century. This great papermaker, incidentally, also introduced the term "deckle" into the English language.

Glazing was once accomplished by the use of a pressing hammer, but since 1720 rollers have been used. The use of these rollers originated in Holland, and they were first cut from trunks of trees. The paper was passed between these revolving rollers. The finish imparted to paper by this device was superior to the one produced by the pressing hammer, as it, in its turn, had been superior to the burnishing process—rubbing paper by hand with a smooth stone. Once paper is "finished," it is ready for packing.

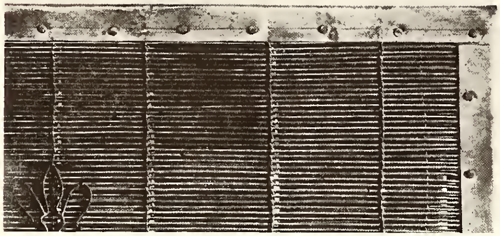
This then is the basic papermaking process as it is, and has been, practiced in a typical European mill for centuries. As can be seen, great coordination is required between the vatman, coucher and layman if this operation is to be a success. One motion out of sequence will upset the rhythmic pattern so important to the smooth functioning of this unique trinity. Among the few changes in the papermaker's tool, three of them concern the vat in which the pulp is prepared for making paper. Sometime during the 17th century, a charcoal heater, known as the "Pistolet," was attached to the vat in order to keep the pulp mixture warm. The 18th century saw the addition of a platform across one side of the vat. The "bridge" enabled the vatman to rest his newly formed sheet of paper in a position to facilitate the drainage of excess water from the mold. The third improvement, and one that America contributed to the art of handmade paper, was the "knotter." The knotter enabled papermakers to remove impurities from the pulp before they became part of a newly formed sheet. This device was first used around 1819.

"Designs-in-wire"—the first use of watermarks

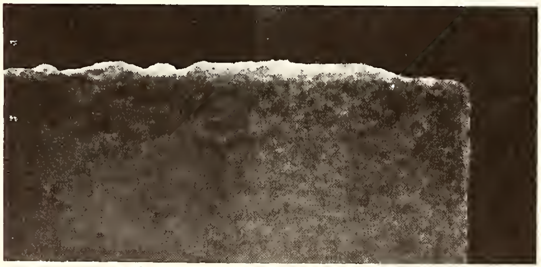
The study of one field of human endeavor almost always leads to byways, often as interesting as the original course. This is the case with watermarks, so closely bound with papermaking. The origin of these designs-in-wire is obscured by the mists of history, but the first known watermark was used in Italy about 1282 (at Fabriano). Almost all theories with regard to their signification are met with rebuttals. We can only surmise and construct at best a patchwork-quilt of isolated facts. It was only very recently, for instance, that these marks began to be used to denote sizes of paper. This study presents a great challenge to anyone wishing to pursue it further. He must love riddles



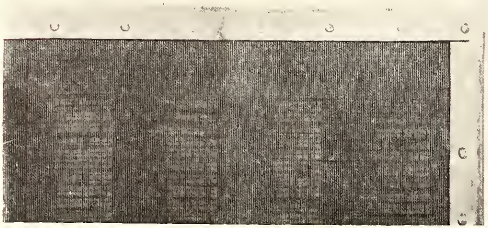
A sheet of "laid" paper with deckle edge. The thin horizontal lines ("laid") are spaced approximately 24 to the inch, vertical ("chain") lines, 1¼" apart.



A corner of a "laid" mold showing copper stripping holding down complex of wires. It is this criss-cross of "laid" and "chain" lines that makes ribbed appearance.



A sheet of "wove" paper. When held to the light, no lines can be seen since this type of paper is formed on a fine mesh of wire cloth. Note the deckle edge.



This is the mold used in the fabrication of "wove" paper. The frame is the same as the one used in "laid," but except for the difference in mold-covering.

and be equipped with a thorough knowledge of papermaking, bookbinding, and general history, and must be well-versed in the principles of bibliography, for he is certain to find rebuttals to his cherished theories at every point.

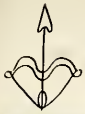
In his highly provocative book, "The Lost Language of Symbolism," Harold Bayley makes the following statement with regard to the *mystical* significance of watermarks: "Independent researches upon which for many years I have been engaged enable me to say with certainty that behind the obvious trade purpose served by watermarks there lies buried one of the most extraordinary romances ever suspected by bibliography. In brief, watermarks are emblems, imperishable thought-crystals in which lie enshrined the traditions and aspirations of many generations of papermakers. It further follows that a correct reading of these emblems throws an unexpected light on the hitherto obscure history of early papermaking, and incidentally, upon many of the dark pages of medieval history..."

This bold history goes on to state that these marks were the cryptographic messages used by pre-Reformation Protestants when they wished to communicate between towns. Naturally, for fear of reprisals, all correspondence or communication between these heretical sects was conducted in great secrecy. What better form of communicaton could there be than innocent-looking marks on a sheet of paper? It should be noted that many papermakers were members of these heretical sects. Auvergne, Albi and many papermaking villages were referred to by ecclesiastical authorities as "the workshops of innovators," "asylums and arsenals of new ideas," etc.

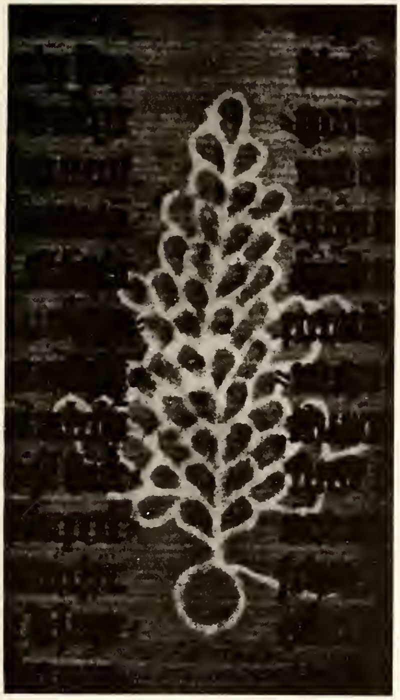
The chiaroscuro watermark and counterfeiting

In the middle of the nineteenth century, the *chiaroscuro*, or light-and-shade, watermark came into use. This beautiful method of watermarking was invented by an Englishman, William Henry Smith, who conceived the idea of making a wax model of a design, covering its surface with graphite or plumbago, and then making an electrotype from it. This "electro" was then backed with a thin coating of lead—enough to render it rigid. The electrotype was then embossed into the finely woven screen which would eventually serve as the "covering" for the "wove" mold. (This type of watermark cannot be successfully embossed upon the coarse surface of a "laid" mold.) With the *chiaroscuro* watermark great fidelity of reproduction can be achieved, and it is often used on "security" papers. Counterfeiting this watermark requires great experience and many years of highly specialized training.

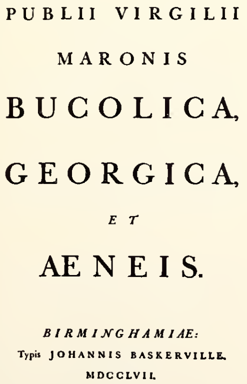
Counterfeiting is usually considered to lie (in its gentler forms) just on the other side of the law. Though this may be true, it takes an uncommon, albeit perverse, ability to be able to reproduce a signature—entire letters in the handwriting of another human being. Perhaps one of the greatest literary hoaxes ever perpetrated on the public concerned the activities of a young Englishman—William Henry Ire-



Bow and Arrow—Italian, 15th Century watermark



An infra-red photo, greatly enlarged, from the Pierpont Morgan Library, showing a cluster of grapes watermark in Gutenberg's Bible of 1455.



PUBLII VIRGILII
MARONIS
BUCOLICA,
GEORGICA,
ET
AENEIS.

BIRMINGHAMIAE:
Typis JOHANNIS BASKERVILLE.
MDCCLVII.

Title page of Baskerville's Virgil, the first book printed on "wove" paper. This paper proved to be especially good for his finely modeled types.

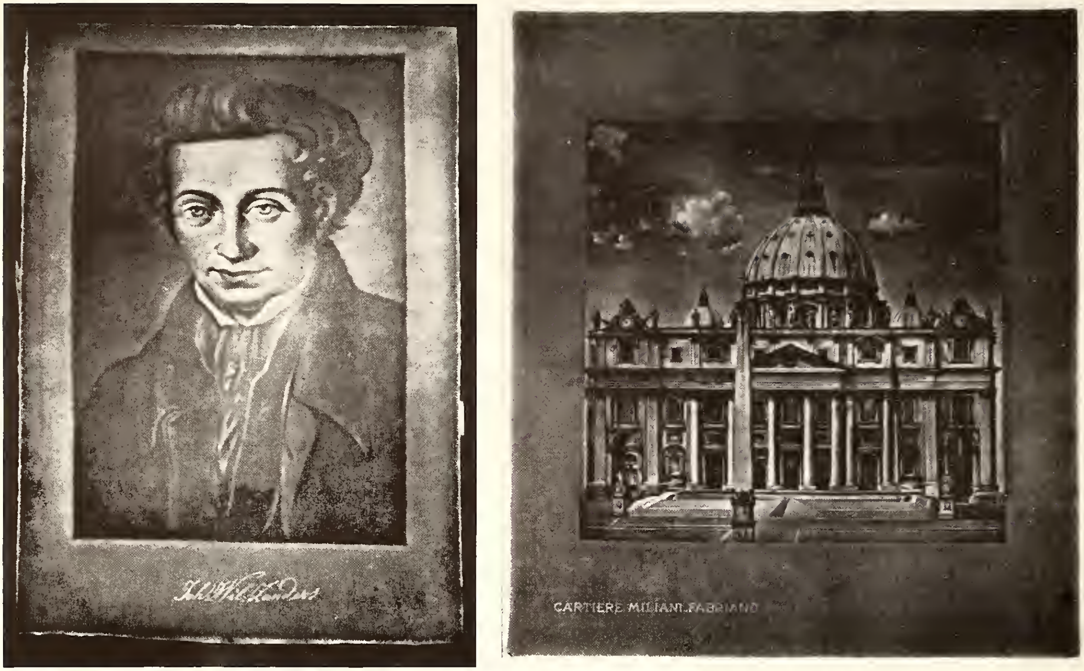
land. This eighteen-year-old had the temerity to forge Shakespeare's name to several documents, and succeeded in duping even the illustrious Samuel Johnson. Ireland (1777-1835) continued to forge Shakespearean documents, crowning his efforts with the writing of a play "Vortigern and Rowena" purported to be a long lost play by the Bard of Avon. In 1805 he blithely published his "confessions" which detailed the techniques used to fool everyone—notably the "experts" of his day.

"But they were so beautiful."

One day during the recent war, The Bank of England's headquarters on Threadneedle Street received news of a bold enemy plan to sabotage its currency. This plan, masterminded by a Major Bernhard Krueger, was so successful that the venerable Bank was forced to withdraw from circulation all £5 notes and substitute new ones of different design. It is reported that the Nazis were able to print and successfully distribute 140,000,000 pounds sterling (then roughly the equivalent of $564,000,000) ! When the tide was beginning to turn for the Germans, Heinrich Himmler gave orders to place these notes in large caches at the bottom of Lake Toplitz, near the village of Redl Zipf, Austria. The craftsmen used in this nefarious scheme were recruited from everywhere, even concentration camps; the best craftsmen in Germany were called upon to "cooperate." When the plan was exposed, one of these craftsmen was quoted as saying: "But they were so beautiful." Eliaza Bazna, the celebrated "Cicero" of the last war, was reported to have been paid £3,000,000 in bogus notes. It is said he committed suicide when he learned that he too had been duped.

Philatelic connoisseurs all over the world have been duped by a tall, gaunt French engraver named Jean de Sperati, who refers to himself as the "philatelic atom bomb." De Sperati is no ordinary forger of rare stamps; he has spent no time in prison, for his aim in life is quite simple, and innocent of wrongdoing. He simply loathes the experts! One "expert," after having been told the stamps he had been very anxious to buy were forgeries, replied "They're so good they make me ill." This engraver with so strong a satirical bent summed up his modus operandi in the following words (*Saturday Evening Post* 4/30/49) "... I have opened the eyes of the blind—the so-called experts. In the history of philately there has never been a man like me. I baffle everybody. Counterfeiter I may be, but I am an artistic counterfeiter." He delights in writing open letters to Parisian dailies exposing the experts as *bêtes* and buffoons. Some day the general public will be given an opportunity to learn his technique and great store of technical knowledge, for de Sperati is planning to issue a huge and expensive tome "exposing all."

The last of this queer "trinity" is an American forger—Martin Coneely, *alias* "Joseph Cosey." The life and works of this master archeological forger were thoroughly dealt with in a *Profile* appearing in the 2/25/56 issue of the *New*



Five hundred years after the invention of line watermarks came "chiaroscuro." These remarkable sheets of paper show this watermarking technique carried to its highest degree of perfection. On the left, a portrait from the J. W. Zanders (Bergisch Gladbach, Germany) collection, and on the right, a view of St. Peter's in Rome. Latter is from the mill of E. Miliani of Fabriano, Italy. Wm. H. Smith, an Englishman, invented this process of embossing *a bas-relief on a wove covering. The Zanders watermark measures* 8″ *x* 11½″, *the Fabriano,* 14⅝″ *x* 17⅛″. *Use of this kind of watermark is sadly unexploited today as a part of letterhead design.*

Yorker. Alcoholic and drug addict, "Cosey" was so skilled in the art of producing bogus Civil War documents and letters, that G. W. Bergquist, then working for the New York Public Library decided to start the "Cosey Collection" in order to remove these amazing documents from general circulation and thus protect the public from an unscrupulous dealer planning to sell Cosey's work to unsuspecting buyers. The expert's great respect for the efforts of a skilled forger is ably summed up in an address by G. W. Bergquist to the Grolier Club in New York. Speaking of Joseph Cosey and those shadowy figures engaged in this perverse art, so much a part of the lore of papermaking, Mr. Bergquist said: "... Decidedly, there is something intriguing in the idea of a person sitting down and deliberately forging the handwriting of some well-known person. Obviously, this is not the work of any ordinary criminal. I am convinced that the person who does this is hardly ever motivated by the sole hope of monetary reward ... Rarely do these forgers sell their goods to the unwary. No doubt, hunger or some other unsatisfied want forces them at times into the displeasing practice of selling a forgery to the ignorant, but certainly they get no pleasure in doing so and must feel that they are prostituting their art, for it is an art, rather than a profession. It is understandable how a man might learn to forge one hand, but marvellous to switch to others at will."

* * *

On September 21, 1958, an article appeared in the New York Times in which Dr. William F. Libby, a member of the Atomic Energy Commission, spoke of a new technique of paper manufacture which would give paper a life span of 20,000 years—longer than all of recorded human history. If this miracle product could be made, what a record future generations will have of primitive man traversing the earth in the twentieth century, learning of our aspirations, our fears and our delusions. They will be so much the wiser—perhaps.

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In keeping with Tamarind's belief that it is our responsibility both to create and to inform, we offer this booklet about fine papers to you. The printmaker's concern with papers is especially profound: the final beauty and viability of an original print are bound to the particular quality of its paper in much the same way that a superb tapestry depends on the quality of its fibre.

The history and technique of handmade papers adds a significant dimension to your knowledge of the original print. It is our hope that Quentin Fiore's excellent article will serve to this end.

A publication describing the papers used at Tamarind, including samples of each, is available on request. Other publications which may be of interest to you are these:

1 - Guide to Tamarind Print Terminology
2 - Tamarind Manual of Style and Usage ($.25)
3 - A Study of the Economic Aspects of a Lithography Workshop ($4.50)
4 - A Study of the Marketing of the Original Print ($4.50)
5 - A Portfolio of Print Furniture Designs ($1.50)
6 - Questions to Ask Your Framer and Answers You Should Get ($.25)
7 - How A Lithograph Is Made and How Much It Costs ($1.50)

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